Chapter 17
Adoption Challenges of Industry 4.0 in Agrisector and Designing a Framework to Reduce It

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ABSTRACT

Agriculture 4.0 technology allows farmers to use trend analysis to predict future weather conditions and crop yields in the coming days. IoT in agriculture helps farmers maintain crop quality and soil fertility, thereby increasing yield and quality. The data collected is used to leverage technological advances to enable better decision-making. By recording data from sensors, IoT devices provide real-time information about plant health. Hence the barriers of Industry 4.0 must be mitigated to improve agrisector. Still people prefer traditional farming process, hence in this chapter, a study is carried out to find barriers of adoption of Industry 4.0 in agrisector and designed a framework to mitigate the challenges.

INTRODUCTION

Industry 4.0 or Fourth Industrial Revolution, has brought many changes to manufacturing sector as well as agrisector. The integration of advanced technologies like automation, artificial intelligence (AI), Internet of Things (IoT), big data analytics, and robotics changed the agrisector to agriculture 4.0. It has changed agrisector into smarter, more connected, and more efficient systems. In the agricultural sector, Industry 4.0 holds immense potential to revolutionize farming practices.It has groomed agrisector by developing modern equipment that were automated and self operated without human effort. Due to advanced and modern equipment productivity increased, resource usage is optimized with increasing sustainability and enhancing food security.Starting from soil quality checking to all kind of farming operations are conducted by modern IoT and AI. Many difficult tasks were conducted in many coun-

tries with the help of robots and robotic technology. Difficult farming tasks like seeding, harvesting, ploughing etc are done within a fraction of second with new devices.Protection of seeds, grains, vegetables, packaging, processing of foods and transportation of agri products are now very easy with the help of different kind of IoT based devices and easy of monitoring and tracking has also enhanced the agribusiness.Due to this farming and agro industries are gaining back their popularity and further young generations were attracted towards it.

Industry 4.0 is transforming the agrisector, By use of sensors and IoT devices soil conditions, crop health, weather patterns, and equipment status can be monitored and generated data can be stored.Variable Rate Technology (VRT) helps to apply seeds, fertilizers, and pesticides at variable rates across a field, It will help to utilize resouces optimally.

The labour oriented difficult tasks like planting, harvesting, spraying, and monitoring tasks can be done automatically with the help of Drones and tractors.Which has improved efficiency with reducing physcal labour and labour cost.Even for plucking use of robotic arms has reduced labour cost increasing harvesting efficiency.

Predictive analysis and farm management softwares are help full in managing and prediction crop health, detect diseases with the help of previous historical data.Remote sensing techniques help to know details about crop health, soil conditions etc.Use of drones for pesticides and fertilizer spraying has reduced risk for farmers.Smart irrigation systems use sensors and weather data to optimize water use, reduce waste and improve crop health. Similarly, nutrient management can also be easy by using sensors for detecting soil fertility.Blockchain technology and market-driven data not only protect crops till they reach the consumer, they also update farmers regarding market demand and prices.Specifically, precision agriculture saves the environment by reducing its carbon footprint.

So, with adoption of industry 4.0, increases the efficiency of crop production and decreases labour and other farming costs. It also provides /updates farmers with advanced technology and provides jobs/ employment opportunities for skilled workforce.

Still for adopting Industry4.0 there are many challenges,which farmers have to confront in future. Due to these challenges till agrisector remains undeveloped and farmers prefer old and conventional methods of farming.Hence, in this chapter a study is carried on to find these challenges and a framework is designed to mitigate these challenges Quality function deployment method.

BACKGROUND

Dwivedi et al(2019) have discussed that AI acts as an transformative technology across almost all industries.The transformative potential of artificial intelligence (AI) in agriculture is highlighted by Liakos et al. (2018), Elbasi et al. (2023), and Sharma et al. (2021). These studies demonstrate AI's capacity for automation, self-learning, human emulation, prediction, and augmentation. These qualities allow AI to reduce environmental impact, improve crop monitoring, and optimize resource allocation—all of which have the potential to transform agricultural output (Elbasi et al., 2023).

Chanchaichujit et al.(2024) have explored the barriers of agri supply chain adoption of Industry 4.0 by ISM method .As per Chanchaichujit Lack of information about technologies and lack of compatibility with traditional methods emerged as the two main barriers that influence each other.Zhai et al.(2020) and Erdoğan(2022) have written that industry 4.0 is the solution for every industry.Latino et al.(2022),

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